

Date: 12th November 2021
Our Ref No.: TJ/UT1/OUT-16

To,
Doosan Heavy Industries & Construction Co., Ltd.
Mr. Youngsoo Son– Project Manager
465 Gangnam-daero, Seocho-gu, Seoul, Korea (06611)

Contract Reference: Engineering, Procurement and Construction Contract between Nepal Water And Energy Development Company Private Limited (NWEDC) and Doosan Heavy Industries & Construction Co. Ltd for the Engineering, Procurement and Construction (EPC) for the 216 MW Hydropower Plant at Upper Trishuli -1, Nepal

Subject: Submission of Review Note on Layout Drawings of Investigation Tunnel for Powerhouse

References:

1. Drawing No.: UT1-C-385-CVL-DG-65001, Rev. B dated 10th October 2021

Dear Sir,

Reference is made to the above No.1 received with transmittal No. UT1-HEP-DHI-D-0071 dated 1st November 2021, regarding layout drawings of investigation tunnel for powerhouse.

Please find our comments in the Review Note (RN-0027) enclosed herewith this letter.

Sincerely,



Mr. Carsten GUNTERMANN
Project Manager (CRE)



Enclosure:

1. Review Notes (RN-0027)

UPPER TRISHULI-1 HEP (216MW)

Client	Nepal Water and Energy Development Company Private Limited
Owner's Engineer	Tractebel Engineering GmbH / Jade Consult

REVIEW NOTE

Contractor	Doosan Heavy Industries & Construction Co., Ltd.		
Title of the Document	Layout Drawing Investigation Tunnel for Powerhouse		
Document No.	UT1-C-385-CVL-DG-65001 (Sheet 1 & 2)	Revision	B
Date of Documents	10.10.2021	Received Date	01.11.2021
Transmittal Form No.	UT1-HEP-DHI-D-0071		
Previous Review Date/Status	20.09.2021/RR	Prev. Review Note No.	RN-0010
Review Note No.	RN-0027	Present Review Date	12.11.2021
		Present Review Status	AC

A: Approved AC: Approved with Comments RR: Returned for Resubmission

Comments

The following comments refer to the drawings of the Layout Plan dated 10. October 2021 as noted above, as well as to the corresponding Reply Comment RC-0004 dated 31.10.2021. The respective review comments are highlighted **in blue** in the marked comments/drawings.

- a) Support details at the portal must not be shown.

Reply: The support details at the portal has been canceled. This is the layout drawing investigation tunnel for powerhouse. It only reflects the overall layout scheme. For the detailed support of the portal, see UT-FC-363-CvL-DG-05002-01 ~ 02.

- b) See Review Note on the Construction Drawings of the tunnel. There refer to the confusing chainage at the portal.

Reply : Generally, as an auxiliary means of mapping, chainage mainly plays a role in recording the relative relationship between positions. In the design of tunnel, the position of the portal is uncertain because of the quality of surrounding rock or the adjustment of the design. If the chainage of the portal is always kept as 0, the chainage may be adjusted frequently, which is troublesome and unnecessary. Therefore, in practice, reference point is more used as the marking method of 0 chainage, e.g. the chainage of reference point is 0.000, which can be recorded as CH0±000.000; Along the forward direction, the chainage is marked with a positive value, such as CH0+100.00; Against the forward direction, the chainage is marked by a negative value, such as CH0-002.740.

- c) The turning bay does not need to be horizontal, as it is also indicated that the selected location may change. This would require different gradients along the tunnel and would require redesign.

Reply: Agree to delete.

- d) Select a uniform gradient for the entire tunnel, wherever the turning bay will be located.

Reply: Agree. Now the uniform gradient for the entire tunnel is adjusted to 7.17%.

- e) Geological structures must not be indicated in this drawing. A small table of major joints sets is sufficient.

Reply: The occurrence of joints and the parameter of joints in the investigation tunnel has been added to the drawings.

- f) Provide "burden Thickness" (= rock cover thickness).

Reply: "burden Thickness" has been added to the properties table.

- g) It is for construction reasons preferable that the tunnel enters the Powerhouse at its roof, i.e., the roof the tunnel, when entering the Powerhouse is at the same elevation as the roof of the Powerhouse. Countercheck with the current Powerhouse design and revise.

Reply: Because the length of the crown rock dowels of the powerhouse is 8m, in order to facilitate the installation of the crown rock dowels during the excavation of the first floor of the powerhouse, we plan to excavate the first floor of the powerhouse and we plan to use double-boom jumbo for drilling construction. Considering the convenient construction traffic, we suggest that the bottom elevation of the ventilation tunnel should be consistent with that of the excavation of the first floor of the powerhouse.

- h) Safety instructions are needed on a layout drawing. Delete. They should appear in the Method Statement.

Reply: Agree to delete.

- i) See separate notes below.
- j) Provide drawings/documents in this list.
- Reply Closed modified.

NOTE

1. This set of drawings are for the excavation and initial support of investigation tunnel for the powerhouse.
2. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
3. Before excavation, the upper slope of the tunnel portal should be cleaned; before removing or **a** the loose block which has a major impact on the slope stability, the site geological engineer should be consulted.
4. The wedges **b** joints combination on the roof shall be **c** and timely.
5. Tunnel excavation should be smooth, and attention **d** be paid to rockburst.
6. The excavation span at the intersection of the investigation **e** and the turning adit is large, and **e** should be paid to timely support to ensure safety.
7. The excavation and support types of the tunnel inlet and tunnel can be adjusted by the designer according to the actual situation after the geological conditions are revealed.
8. The end position of the investigation tunnel may be adjusted according to the final position and section size of the powerhouse.
9. The location of the turning adit may be adjusted according to the actual rock conditions.

- a) Delete this comment. It is related to construction and not to layout. Such comment should appear in the **Closed** or on construction drawings.

Closed

delete.

Closed

under a).

delete.

- c) Same as under a). Note, there is no rock burst to the project, so far.

Closed

delete.

Closed

under a).

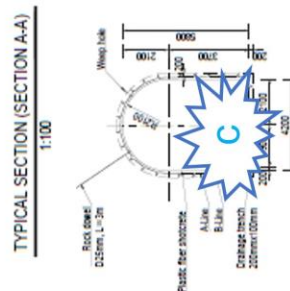
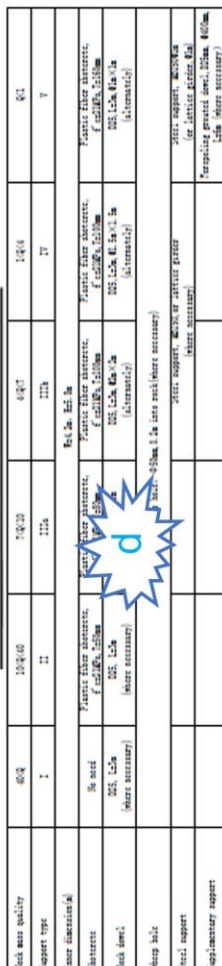
delete.

- e) Modify this comment: The Designer shall provide alternatives and options in the tunnel support design, so that the support can be adjusted in case

Closed

itions are varying.

Reply: The excavation and support methods of the tunnel portal can be adjusted according to the actual situation after the geological conditions are revealed.

MECHANICAL PARAMETER OF JOINTS

Joint type	JMC	JMC (MPa)	ϕ_c (°)
flexion	6	10	25.0
lithoclase cemented [20, 21]	0	50	20.0

OCURRENCE OF JOINTS

Joint No.		
2 (Failure)	3.48°	20°
3	2.25°	10°
7	2.5°	50°

1. This set of drawings are for the layout drawings of investigation tunnel for the powerhouse.
2. All dimensions are in millimeters, and coordinates, changes & elevations are in meters.
3. The end position of the investigation tunnel may be adjusted according to the final position and section size of the powerhouse.
4. The location of the turning adit may be adjusted according to the actual rock conditions.

SCALE:

1:500

1:100

FOR REVIEW

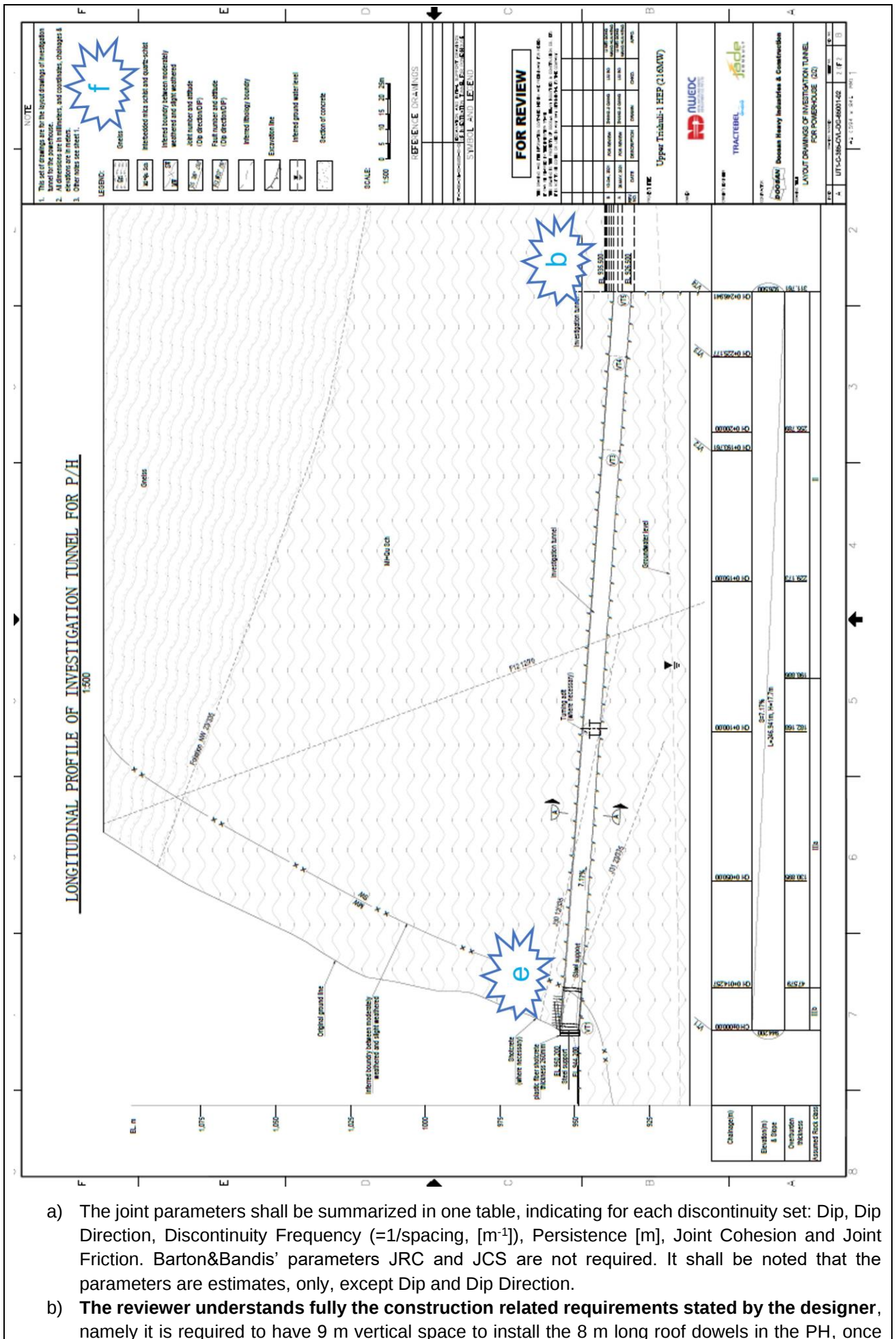
Upper Tribunal (1st HEF (216NW))



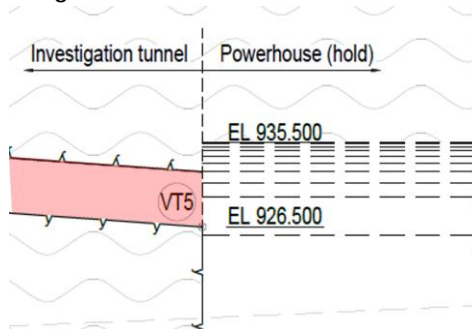
TRACTEBEL

DOORAN DOORAN Heavy Industries & Construction
- 1 - 103
LAYOUT DRAWINGS OF INVESTIGATION TUNNEL

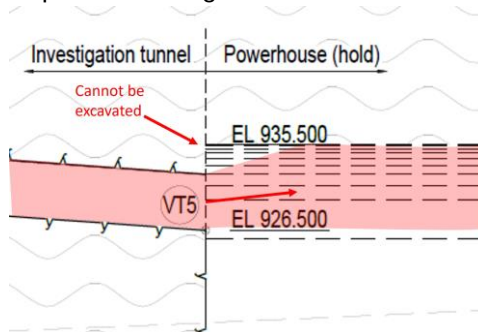
1-6	one per side	100
4	UT1-C-385-CVL-C-05501-01	1 (F)



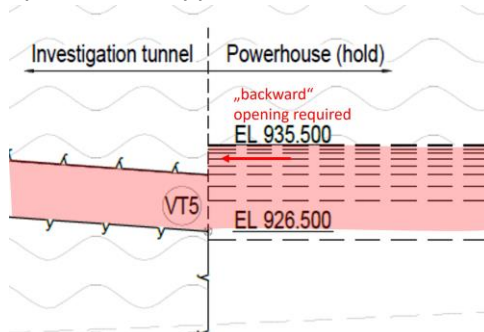
entering the PH. However, the current drawing, with the roof of the Ventilation tunnel entering the PH 3 m below the roof of the PH is highly inconvenient to construct, time consuming, costly – and dangerous. The reasons are shown as follows:



Once the Ventilation Tunnel has approached the PH it would be required to fully open the tunnel to the PH profile (9 m height). This can be drilled for the next round. However, the following first blast for the PH would automatically lead to high damage of the already supported roof of the existing Ventilation Tunnel. Therefore, there is no other way than to slightly open the tunnel profile to the required 9 m height as shown in the following figure.

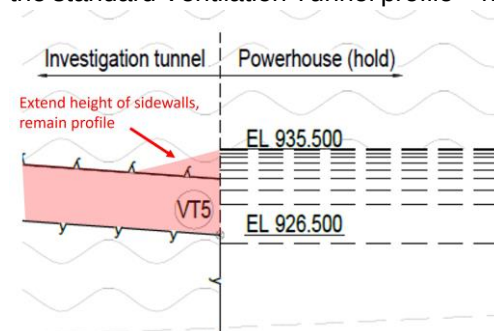


As it is needed to excavate the remaining rock section later on, no support can be applied in the roof of the heightened area, because it would be anyway removed later on. Furthermore, it is required to open this unsupported rock section “backward” as shown in the following figure.

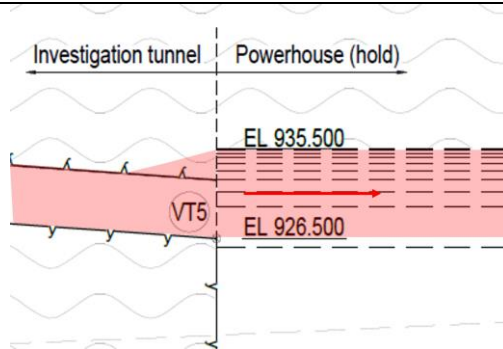


To overcome all these difficulties, inconvenience and hazards during construction **it is strongly recommended that the designer considers the following:**

Start to increase height of the vertical sidewalls of the Ventilation Tunnel continuously, begin three rounds (say 7.5 m) before entering the PH. This would require in the tunnel roof the same support as the standard Ventilation Tunnel profile – not more - and a few additional dowels in the sidewalls, only.



Once the PH is reached, the 8 m long dowels can be installed in the roof, immediately.



- c) This is a Class II tunnel section, which has not yet been approved. Indicate a section with the required clear space, only. Provide a note that the excavation profile depends on the rock class and the respective support thickness.
- d) This table should appear on the construction drawing, but not on this layout drawing. Delete.
- e) Details of portal support not required, refer to respective drawing.
- f) Provide a note that this drawing reflects the current status of the design, but the alignment may be adjusted during an optimization process., if it is of benefit to the project. Revise accordingly.

Dr. Ulrich Glawe

(Signature)